

U.S. Environmental Protection Agency

Proposed Plan
for
Northwest Pipe & Casing Company / Hall Process Company
Clackamas, Oregon
Groundwater Operable Unit
May 2001

This Proposed Plan identifies the Preferred Alternative for cleaning up contaminated groundwater at the Northwest Pipe & Casing Company / Hall Process Company Site located in Clackamas, Oregon. This document also compares the other alternatives EPA considered for cleaning up the groundwater. The Site is the former location of pipe manufacturing and pipe coating facilities. The Proposed Plan is a final action that will address contaminated groundwater at the site.

EPA is recommending in the Proposed Plan, several different actions to address all parts of the groundwater contamination:

- Installing *in-situ* air stripping wells** in four areas of the site to treat groundwater contaminated with high levels of volatile organic chemicals (VOCs) and in a fifth area of the site, if necessary, to prevent the off-site movement of contaminated groundwater;
- Monitoring groundwater** to evaluate the effectiveness of *in-situ* air stripping and measure the progress towards achieving groundwater cleanup goals;
- Controlling erosion during construction** of the groundwater remedy to minimize the amount of sediment going to the nearest water bodies. Excessive sediment threatens the quality of the water and critical habitat of threatened or endangered anadromous fish;
- Limiting future access to and use of site groundwater**, through institutional controls, to ensure the remedy remains protective of human health.

EPA is proposing to treat contaminated groundwater with the Preferred Alternative for a period of at least five years and possibly up to ten years. Until cleanup goals are met, groundwater will be monitored routinely and institutional controls will be used to restrict use of the groundwater.

This document explains the groundwater Preferred Alternative and summarizes the other cleanup options evaluated for use at this site. This document is issued by the U.S. Environmental Protection Agency (EPA), the lead agency for site activities, and the Oregon Department of Environmental Quality (DEQ), the support agency. EPA, in consultation with the DEQ, will select

a final groundwater remedy for the site after reviewing and considering all information submitted during the 30-day public comment period. EPA, in consultation with DEQ, may modify the Preferred Alternative or select another action presented in this Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives presented in this Proposed Plan.

The Northwest Pipe and Casing Company site involves multiple contamination problems. For the purpose of managing the site-wide response actions, EPA has organized response actions into two operable units (OUs), Soil and Groundwater. This Proposed Plan is for the Groundwater Operable Unit. In June 2000, EPA issued a Record of Decision (ROD) for the Soil Operable Unit at the site. The soil cleanup selected in the soil ROD includes excavation of the soil most highly contaminated with polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and VOCs, either offsite thermal treatment or offsite landfill disposal of the excavated soil, and placement of a two-foot cap of clean soil over the site. EPA could start construction of the soil cleanup in the summer of 2001, pending the availability of funding. Timing of the groundwater cleanup is not dependent on completion of the soil cleanup, because the contaminated soil is not a significant source of the groundwater contamination.

EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation (RI) and Feasibility Study (FS) report and other documents available for review at the site Information Repositories listed below. EPA and the State encourage the public to review these documents to gain a more comprehensive understanding of the site and Superfund activities conducted at the site. The Administrative Record file, which contains information that will be the basis to select the final groundwater cleanup alternative, is also available at the Information Repositories listed below:

US EPA Records Center
Region 10
1200 6th Avenue, 7th Floor
Seattle, WA 98101
(206) 553-4494

This office is located in downtown Portland.

Clackamas County Library
Clackamas Corner Branch
11750 SE 82nd Avenue, Suite D
Clackamas, Oregon
(503) 652-2640

The library is at the NE corner of the Clackamas Town Center Mall parking lot.

COMMUNITY PARTICIPATION

How You Can Participate: The public is encouraged to participate in the decision-making process by commenting on this proposed plan. EPA will accept written comments on this proposed plan during the public comment period from **May 17, 2001 through June 18, 2001**. All public comments will be considered by EPA prior to reaching a final decision. Written comments should be addressed to:

Alan Goodman
U.S. Environmental Protection Agency
811 SW Sixth Avenue, 3rd Floor
Portland, OR 97204
e-mail:goodman.al@epa.gov

EPA will host a public meeting if sufficient interest is expressed. To request a public meeting, send a written request to the address above or call Alan Goodman at (503) 326-3685 before May 24, 2001.

In addition to this plan, related project documents are available for review at the Administrative Record locations listed in the previous section. Please call EPA's Records Center at 206 553-4494 to obtain the most current information on their office hours. The Administrative Record is a collection of all the documents which EPA relies on for making site decisions. These related project documents can give you a more comprehensive understanding of the site and the cleanup activities that have been conducted.

EPA will respond to public comments in a document called a Responsiveness Summary. A final Record of Decision will then be prepared by EPA. The Responsiveness Summary will be part of the Record of Decision and will be available for review at the locations listed above.

SITE LOCATION AND HISTORY

The Northwest Pipe & Casing Company / Hall Process Company ("NWPC") site is located between S.E. Lawnfield and S.E. Mather Roads in Clackamas County, Oregon (**Figure 1**), and is approximately twenty miles southeast of Portland. The site is adjacent to Southern Pacific Railroad tracks and approximately one-half mile east of Interstate Highway 205.

The site, which is about 53 acres, is located in a mixed commercial and light industrial district. Property immediately east of the site, formerly an automobile junkyard, is currently vacant. A small residential community known as Hollywood Gardens is located approximately one-half mile southeast of the site. The bluff west of the site is occupied by retail and commercial businesses.

Beginning in 1956, Hall Process Company (HPC) operated a pipe-coating facility on Parcel B (32 acres) (see **Figure 2**). Beginning In 1967 and until operations ceased in 1985, Northwest Pipe & Casing Company manufactured and stored steel pipe on Parcel A (21 acres). In 1978, HPC ceased operations on Parcel B and the pipe-coating facility was leased to NWPC, which continued pipe-coating until 1985.

Pipe coating operations involved sandblasting pipe with steel shot, spraying the pipes with primer, and applying the coating material. Coal tar, coal tar epoxy, asphalt, polyethylene epoxy, and concrete were used as coating materials. A volatile-organic based primer was used to adhere pipe coatings and solvents were used in the maintenance of pipe-coating equipment.

The site was placed on the Superfund National Priorities List (NPL) in October 1992. EPA conducted a formal investigation between 1996 and 1998 and performed additional groundwater monitoring and investigations in 1999 and 2000. The results of these site investigations and analyses of cleanup alternatives are contained in the Remedial Investigation Report, Feasibility Study Report, 1999 Groundwater Monitoring Report and the 2000 Groundwater Investigation and Monitoring Report.

Previous Public Involvement: A Community Involvement Plan was developed in 1992. EPA created a mailing list of interested parties and set up local information repositories. Since then, the agency has periodically issued fact sheets to keep interested parties informed about cleanup progress at the site. A public hearing and comment period on the proposed soil cleanup plan for the site was held in February 2000. Community concerns revolved around the likely heavy truck traffic during the soil cleanup through a nearby residential neighborhood.

SITE CHARACTERISTICS

In the past, pipe manufacturing and coating operations were the principal sources of contamination on the site. Wastes including spent solvents, primers, excess coating material (coal tar), coating product containers, condensed coal tar residues and oils, pipe trimmings, and engine and hydraulic oils were disposed at various locations on Parcel B by burial, dumping, burning and spreading. Leaks and spills also occurred on Parcel B. Soils and groundwater on the site are contaminated as a result of past waste handling practices. The RI/FS identified the types, quantities and locations of contaminants and developed ways to address the contamination problems. The primary contaminants identified in soils at the site include polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Chlorinated volatile organic compounds (VOCs) are the principal contaminants in groundwater beneath the plant site.

Manmade drainage ditches run along the east and west site boundaries. These drainage ditches flow north into Dean Creek which merges with Mt. Scott about 1.5 miles downstream (see **Figure 2**). Dean Creek and Mt. Scott Creek provide wildlife habitat for resident and anadromous fish species.

The site is not in a floodplain, but is susceptible to ponding due to poor drainage. Groundwater is at or within a few feet of the ground surface in the wet season. A site survey done in 1997 concluded that wetlands were not present; however, new information indicates wetlands may be present at the site. A wetland delineation survey is planned for the spring 2001.

Geology of the area consists of coarse-grained Clackamas River fluvial deposits overlain by silt- and clay-rich flood deposits. Five geologic units (layers of different soil types) have been

identified at the site. The geologic conditions at the site are summarized on a cross section diagram of the site, **Figure 3**.

Two aquifer systems (water-bearing formations) are located beneath the site. The Upper Aquifer consists of poorly sorted fine-to-coarse gravels and sandy gravels with occasional sand/silt zones in the upper gravel unit which underlie the upper silt/fill/debris units. The upper aquifer extends to depths of 87 to 103 feet below ground surface (bgs). All monitoring wells, with one exception, installed during the RI and other EPA investigations were completed in the upper aquifer. The Lower Aquifer is an artesian gravel unit, located beneath the lower silt unit. The Oregon Department of Transportation (ODOT) industrial well, reportedly used by Northwest Pipe & Casing Company for process water in pipe manufacturing, is screened in the lower aquifer. The ODOT well is not currently in use. EPA installed a monitoring well in the lower aquifer during the 2000 supplemental groundwater investigation.

Groundwater flow direction in the upper aquifer is northwest, with no significant seasonal changes observed. Groundwater flow velocity in the upper aquifer at the site is 0.3 foot/day. The volume of groundwater flowing through the upper aquifer at the site is estimated to be 101,000 gallons/day.

Shallow groundwater in the upper aquifer discharges seasonally to the adjacent manmade drainage channels in the southeast and southwest parts of Parcel B. It is unknown if the drainage channels have much direct influence on groundwater flow in the intermediate or deep parts of the upper aquifer. A groundwater dewatering system consisting of two tiled vertical drains is present on the western side of the ODOT building on Parcel A. The drains, likely installed when NWPC used the building for pipe manufacturing, locally depress the water table by about 2 to 4 feet.

Groundwater at the NWPC site is not currently used nor expected in the future to be used for drinking water. However, under federal groundwater guidelines, EPA considers the site groundwater to be a *potential* source of drinking water and therefore is classified as Class II. The closest known downgradient withdrawal of groundwater for domestic purposes is approximately one and one-half miles northwest of the site.

SCOPE AND ROLE OF THIS RESPONSE ACTION

The action being considered in this proposed plan is part of an overall strategy for cleanup of the Northwest Pipe & Casing Company / Hall Process Company site. Past response actions addressed the most immediate threats at the site. Completed past response activities and soil cleanup actions selected by EPA in June 2000 are outlined below. This Proposed Plan for Groundwater would be the final action planned by EPA for the site.

Parcel B has been vacant and unoccupied since the late-1980s. Transients trespassed on the site to use buildings for temporary shelter. EPA constructed a perimeter security fence with warning signs around Parcel B to minimize the potential for people having direct contact with surface contamination. Additionally, all former plant buildings on Parcel B were demolished. These buildings were being used by transients as temporary shelter. Demolition debris was removed for off-site disposal; metal debris from buildings was recycled off-site. Approximately 230 tons of

surface debris -- coal tar chunks, metal bins containing solidified coal tar, and abandoned car tires and batteries -- were removed from Parcel B in 1997. Two underground storage tanks (USTs) were removed from Parcel B in 1998. Security patrols were started in 1999 and have been successful in controlling transient access to the site.

In June 2000 EPA issued a Record of Decision (ROD) for the Soil Operable Unit OU1. The soil cleanup action selected by EPA included excavation of the most highly contaminated soil, either off-site thermal treatment or off-site landfill disposal of the excavated soil and a soil cap over the lesser contaminated soil remaining at the site. Soil cleanup levels were set to protect persons from risks due to direct contact with the contaminated soil and to restrict migration of soil contaminants to the groundwater. EPA could start construction of the soil response actions in the summer of 2001, pending the availability of funding. The soil cleanup is likely to be completed before the groundwater cleanup is started; however, starting the groundwater cleanup is not dependent on first completing of the soil cleanup, because the contaminated soil is not a significant source of the groundwater contamination.

NATURE AND EXTENT OF GROUNDWATER CONTAMINANTS

The remedial investigation was a comprehensive effort to gather and analyze data to study the contamination in soil, debris, surface water, sediment and groundwater. Additional information was gathered during supplemental groundwater investigations in 1999 and 2000. The nature and extent of groundwater contamination is summarized in the following subsections. Information on the extent of soil, surface water and sediment contamination is not included because it was presented previously in the Soil OU ROD.

EPA collected information on upper aquifer groundwater quality and hydrogeology from a network of more than 30 groundwater monitoring wells. Additionally, a truck-mounted direct push-probe sampling device was used at a few dozen locations on the site to provide further information on groundwater quality. The upper aquifer has been classified as shallow, intermediate and deep zones for data collection and analysis purposes, based on the depth of the screened interval. Chlorinated solvents, principally perchloroethylene (PCE), are the primary chemicals detected in groundwater at the site. Trichloroethene (TCE), cis-1,2 dichloroethene (DCE), and vinyl chloride are also present in groundwater; in most cases they are believed to result from degradation of PCE. In many instances, concentrations of these chemicals were significantly greater than permissible limits for drinking water, designated Maximum Contaminant Levels (MCLs), set under the federal Safe Drinking Water Act. The chlorinated VOCs were found to be present extensively across Parcel B and the western portion of Parcel A. During the RI, groundwater sampling revealed the following:

1. PCE was detected in 44 out of 78 groundwater samples, ranging from 0.2 to 11,000 µg/L. The MCL for PCE is 5 µg/L.
2. TCE was detected in 53 out of 78 groundwater samples, ranging from 0.2 to 1,900 µg/L. The MCL for TCE is 5 µg/L.
3. Cis-1,2-DCE was detected in 59 out of 78 samples, ranging from 0.4 to 3,000 µg/L. The MCL for cis-1,2-DCE is 70 µg/L.

4. Vinyl chloride was detected in 44 out of 84 samples, ranging from 0.6 to 340 µg/L. The MCL for vinyl chloride is 2µg/L.

Dense nonaqueous phase liquids (DNAPLs) were not observed in any of the monitoring wells at the site.

Four areas of groundwater, referred to as plumes, containing PCE and its breakdown products were identified in the upper aquifer. The areal extent of PCE in groundwater and the locations of the groundwater plumes are shown in **Figure 4**. Three plumes originate in the southeast corner, the southwest corner and near Plant 3 on Parcel B respectively. The approximately 1,500-foot long plume arising at Plant 3 has had the highest levels of PCE detected (11,000 µg/L) in the groundwater at the site. A fourth plume of PCE-containing groundwater also exists on the western (ODOT) lot of Parcel A and appears to be comingled with the plume arising from Plant 3. The source of this plume is unknown, as chlorinated VOCs were not detected where the source of contamination was expected to be in soil southeast of the ODOT building. No further investigation of soil in this area is planned, since EPA plans to address the groundwater plume with actions contained in this proposed plan.

The concentrations of chlorinated solvents decrease with depth in the upper aquifer, although the VOC concentrations still exceed safe drinking water standards at depths up to 50 feet bgs. The shallow portion (0 to 20 feet bgs) of the upper aquifer is most impacted by the chlorinated solvents. None of the plumes of contaminated groundwater have moved off the site to date.

Elevated concentrations of PCE above safe drinking water standards were intermittently detected in the artesian industrial well IW-01 screened in the lower aquifer on the ODOT property. The PCE in this well, IW-01, is believed for several reasons to originate from an off-site source rather than from contaminated groundwater at the Northwest Pipe & Casing Company / Hall Process Company site. First, testing during the RI showed that the upper aquifer does not appear to be hydraulically connected or flowing freely to the lower aquifer in the immediate vicinity of the Northwest Pipe & Casing Company / Hall Process Company site. Also, VOCs were absent in the deepest portion of the upper aquifer on the NWPC site, indicating that this part of the upper aquifer was not transferring VOCs to the underlying lower aquifer. Further groundwater investigation at the site in 2000 did not result in more conclusive information on the source of PCE detected at the ODOT well in the lower aquifer.

Other contaminants were found to a limited degree in site groundwater. PAHs, principally acenaphthalene, fluoranthene, and naphthalene were detected at low concentrations only in limited locations in the shallow part of the upper aquifer groundwater. (PAHs are one of the principal contaminants of soil at the site.) These concentrations were markedly lower than levels measured during a previous field investigation in 1990. Inorganic constituents such as metals were detected in groundwater on site at relatively low concentrations, although the levels were higher than in up gradient samples; however, no distinct plumes were recognized. PAHs and inorganic constituents are not considered contaminants of concern for the groundwater.

SUMMARY OF SITE RISKS

EPA conducted a baseline risk assessment as part of the RI/FS. A baseline risk assessment estimates the likelihood of health problems if no cleanup action were taken at the site. The following description of site risks in this proposed plan is limited to risks from groundwater, because risks posed by soil, surface water and sediment at the site were described and addressed by the soil operable unit Record of Decision (ROD) issued by EPA in June 2000.

Actual or threatened releases of hazardous substances from this site, if not addressed by the preferred alternative or one of the other active measures considered, may present a current and/or future threat to public health, welfare, or the environment.

Human Health Risks

The Northwest Pipe & Casing Company / Hall Process Company site is currently zoned for industrial/commercial use. Land use is reasonably expected to remain industrial/commercial for the site. According to county officials, the site represents a potentially valuable developable property in Clackamas County due to its size and proximity to transportation corridors. Other surrounding property to the east and west is zoned similarly and currently used for a variety of commercial and industrial purposes. A small residential area known as Hollywood Garden is located approximately one-half mile southeast of the site.

A highway project known as the Sunrise Corridor, being planned by the Oregon Department of Transportation, includes an interchange which would cross over a portion of the NWPC site. The highway project is not currently funded, although ODOT has been purchasing right-of-way. ODOT officials have advised EPA that construction of the interchange would be at least five years away, due to lack of funding.

Groundwater at and immediately downgradient from the site is not currently used for drinking water. Businesses and residences in the site vicinity are connected to Clackamas County Water District. However, the groundwater is considered to be a potential source of drinking water in the future and therefore is classified as Class II groundwater under EPA's federal groundwater classification system. There are no known immediate plans for use of the groundwater at or in the vicinity of the site.

Cancer Risks for Current Exposures

No current human receptors were evaluated because no current populations are likely to be exposed to site groundwater contaminants on a regular basis.

Cancer Risks for Future Exposures

The likelihood of any kind of cancer resulting from a Superfund site is expressed as a probability. For example, a "1 in 10,000" chance would mean that for every 10,000 people in the area, one extra cancer case may occur as a result of exposure to site contaminants. EPA generally requires remedial action at sites where the excess cancer risk from exposure to all contaminants exceeds 1 in 10,000. DEQ's target risk levels are exceeded when the total excess cancer risk exceeds 1 in

1,000,000 for an individual carcinogen or 1 in 100,000 for cumulative carcinogens, i.e. sum of the exposure to all carcinogens.

The baseline risk assessment for the NWPC site indicates that the future group with the highest potential for increased cancer risk from exposure to groundwater would be future maintenance workers and future off-site residents. The future off-site residential exposure was based on a worst-case scenario in which contaminants at the site migrated to a hypothetical domestic well immediately downgradient from the site in the same concentrations as they are found on-site. Risks from dermal contact, ingestion and inhalation of volatiles from groundwater were considered. A maintenance worker could become exposed to shallow groundwater through outdoor grounds maintenance activities. Reasonable maximum exposure (RME) risk estimates for an on-site maintenance worker exceed a cumulative lifetime cancer risk target of 1 in 10,000. The RME portrays the highest level of human exposure that could reasonably be expected to occur from site contaminants. RME risk estimates for a future off-site resident would exceed 1 in 1,000. The cancer risk for exposure via from dermal contact, ingestion and inhalation of volatiles from contaminated groundwater is primarily due to VOCs.

Non-Cancer Risks

Non-cancer risks are measured by an evaluation system called the Hazard Index (HI) that generates a numeric value. A HI value greater than 1.0 may indicate a need for action. The increased risk of noncancer health impacts for on-site maintenance workers for exposure via dermal contact, ingestion and inhalation of volatile chemicals from groundwater did not exceed 1.0, and the HI was slightly greater than 1 for a future off-site resident.

Uncertainty

The numerical estimates in a risk assessment (risk values) have associated uncertainties reflecting the limitations in available knowledge about site contaminant concentrations, exposure assumptions (e.g., chronic exposure concentrations, intake rates) and chemical toxicity. At the NWPC site, groundwater samples were collected based on the location of known or suspected areas of contamination. Therefore, these samples may disproportionately represent more contaminated areas of the site. This will tend to overestimate the exposure concentrations of contaminants and therefore exposures and consequently risks may be overestimated.

Ecological Risks

The ecological risk assessment is a study of the actual or potential effects of contamination at the site on plants and animals. Since there is no direct exposure of ecological organisms to groundwater at the site, there is no associated ecological risk. However, groundwater in the southern portion of Parcel B may discharge seasonally to surface water in the adjacent drainage ditch. Therefore, the ecological risk assessment evaluated exposures for piscivorous (fish-eating) birds, by simulating exposure to surface water with VOC concentrations similar to the concentrations found in the groundwater at the site. The results indicate that adverse effects are not likely to occur to piscivorous birds that feed in the on-site drainage channels or off-site creeks.

Dean Creek and Mt. Scott Creek downstream from the site provide habitat for several anadromous fish species listed by National Marine Fisheries Service (NMFS) as threatened.

EPA determined that erosion management measures may be necessary during groundwater remedy construction activities at the site to ensure there would be no likely adverse effects on threatened fish species or their essential habitat. Under an informal consultation EPA conducted with the NMFS pursuant to the Endangered Species Act, NMFS concurred with EPA's determination. Therefore, the groundwater remedial alternatives developed by EPA include erosion control measures to protect threatened species.

REMEDIAL ACTION OBJECTIVES

Based on site risks and federal and State of Oregon environmental cleanup requirements, EPA has established the following Remedial Action Objectives (RAOs) to prevent unacceptable exposure to upper aquifer groundwater at/from the site:

Restore and maintain use of the upper aquifer groundwater as a drinking water source. The goals for restoration are the federal and state safe drinking water standards (MCLs), which are 5 µg/L for PCE, 5 µg/L for TCE and 2 µg/L for vinyl chloride.

Prevent exposure of future off-site residents and future on-site maintenance workers through direct contact (ingestion, dermal contact and inhalation) to contaminated upper aquifer groundwater that would result in an excess lifetime cancer risk greater than one in 1,000,000 for individual carcinogens, above 1 in 100,000 for additive carcinogenic contaminants, or above a Hazard Index of 1.

Prevent movement of upper aquifer groundwater with contaminant concentrations that would result in an excess lifetime cancer risk greater than one in 1,000,000 for individual carcinogens, above 1 in 100,000 for additive carcinogenic contaminants, or above a Hazard Index of 1 to off-site areas or deeper aquifers.

In order to meet these objectives, EPA developed Preliminary Remediation Goals (PRGs) for the upper aquifer groundwater. Typically, EPA would use the safe drinking water MCLs as the PRGs for groundwater in an aquifer which could be used for drinking water. The MCLs are 5 µg/L for PCE, 5 µg/L for TCE and 2 µg/L for vinyl chloride. However, the State of Oregon Environmental Cleanup Law, which is an applicable or relevant and appropriate requirement (ARAR), requires that risk-based cleanup levels be set to achieve an excess lifetime cancer risk of no greater than one in 1,000,000 for individual carcinogens. Therefore, using the exposure scenarios and results of the baseline risk assessment EPA calculated risk-based cleanup goals as follows:

- 0.9 µg/l for PCE,
- 1.6 µg/l for TCE
- 0.02 µg/l for vinyl chloride

Since the risk-based cleanup goals for PCE and vinyl chloride are lower than their respective

detection limits of 1.0 µg/l using standard analytical methods, in accordance with DEQ guidance EPA raised these cleanup goals to correspond with the chemical's detection limit. Accordingly, the modified PRG concentrations are as follows:

- 1.0 µg/l for PCE,
- 1.6 µg/l for TCE
- 1.0 µg/l for vinyl chloride

These PRGs are lower than the MCLs for the respective contaminants because the risk-based approach to development, required for use by the state, results in lower concentrations.

ALTERNATIVES FOR UPPER AQUIFER GROUNDWATER CLEANUP

Groundwater modeling predicts that groundwater VOC concentrations would exceed the provisional cleanup goals on-site for greater than 200 years if nothing was done. Also, the modeling predicts movement of groundwater exceeding the provisional cleanup goals to off-site areas may occur; the maximum distance of off-site exceedance of the PCE cleanup goal is predicted to be 100 feet north of Lawnfield Road.

Since groundwater at the site is not currently used for domestic purposes, and there is no near-term future need to use the groundwater for domestic purposes, EPA believes it is reasonable to consider a longer period of time to achieve restoration cleanup concentrations. Accordingly, some of the remedial alternatives include a passive remediation component which would meet cleanup goals in a longer period of time.

EPA evaluated a number of remedial options for meeting the groundwater RAOs. The FS report presents a complete description of these options and is available at the site information repositories identified earlier. The FS screened the remedial options and grouped the best options into 5 alternatives. Technologies/process options which were retained after screening included monitored natural attenuation (MNA), *in-situ* air stripping, pump and treat systems and permeable reaction walls. In addition, a no-action alternative was included for evaluation (as required by CERCLA) to establish a baseline for comparison with the various remedial alternatives.

Two of the five groundwater alternatives each contained four different treatment and/or disposal process options. These options represented different approaches to meeting the RAOs. Thus, a total of ten remedial alternatives/options were given a detailed evaluation in the FS Report, in addition to the no-action alternative.

Subsequent to the Feasibility Study EPA made changes to the final remedial alternatives. Monitored natural attenuation (MNA) was reevaluated for effectiveness. EPA concluded that MNA processes may have occurred in some parts of the upper aquifer, as evidenced by the presence of products that result from PCE decay. However, the available information was insufficient to demonstrate MNA processes were occurring to a significant degree in all plumes. Therefore, EPA revised the evaluation of MNA to reflect the uncertainty of MNA's ability at the site to meet groundwater remedial goals. Also, the permeable reaction wall option for plume

interception was reexamined. EPA dropped this option from further consideration because its' costs were significantly higher than the *in-situ* air stripping and pump and treat system options without a corresponding increase in overall protection of human health. Finally, EPA added treatment for Plume 2 to all final alternatives because the groundwater investigation in 2000 showed contamination in Plume 2 was more extensive laterally and deeper than prior data indicated.

Cleanup time periods for all alternatives were estimated, based on attaining the groundwater remediation goals. Federal and state drinking water standards are likely to be achieved throughout the site sooner.

All of the final alternatives involving active remediation include source control measures in all of the groundwater plumes. The purpose of active treatment is to reduce the concentrations of VOCs in the most highly contaminated groundwater areas to a significant extent in order to achieve significant progress towards meeting MCLs and to actively restrict future off-site movement of contaminated groundwater. Since the risk-based cleanup goals are more stringent than the MCLs, institutional controls, as discussed below, will be used to restrict future exposure.

Elements Common to all Groundwater Alternatives

The final remedial alternatives contain some common elements that are briefly described below.

Long-term groundwater monitoring of all plumes is included in all alternatives (except the no action alternative). Monitoring would be performed to assess the progress of the remediation over time and allow adjustments to be made as needed.

A discount rate of 5 percent and a period of 30 years for operation and maintenance (O&M) were used to estimate costs.

Institutional controls to restrict domestic use of groundwater exceeding cleanup goals are included in all action alternatives, because the alternatives may require a long period of time to achieve the RAOs. These controls include, for example, restrictive easements, deed restrictions and property use restrictions. Alternatives that do not eliminate potential off-site contaminant movement in the future, may require off-site institutional controls to limit human exposure to the off-site portion of the contaminated groundwater plume.

All remedial alternatives which involve construction activities would include erosion management controls during construction to protect the habitat of federally threatened fish species in downstream creeks from adverse impacts.

Alternative G-1: No Action The no action alternative provides a baseline for comparing other alternatives. It establishes the risk levels and site conditions if no remedial actions are implemented. No changes would be made to current site conditions. No engineering or institutional controls would be put in place and no remedial actions would be taken to reduce groundwater hazard levels at the site.

Capital Cost:	\$ 0
Annual Operation and Maintenance Cost:	\$ 0

Alternative G-2: Monitored Natural Attenuation; This alternative relies solely on natural attenuation processes and long-term monitoring to reduce VOC concentrations and control contaminant migration. A total of 32 additional monitoring wells would be installed in the source areas for Plumes 1, 2, 3 and 4, downgradient of these source areas, and downgradient of the exceedance area. Samples would be collected annually from the monitoring wells for a period of 30 years and analyzed for VOCs including PCE, TCE, DCE and vinyl chloride and for parameters that indicate conditions supportive of natural attenuation processes to ensure that MNA would achieve cleanup goals.

Institutional controls such as property use restrictions on Parcels A and B would be implemented to prevent future human exposure to groundwater contaminants due to site redevelopment or well installation. Off-site institutional controls such as property use restrictions would be implemented at a future date if contaminated groundwater migrated to off-site areas.

Capital Cost:	\$147,600
Annual Operation and Maintenance Cost:	\$ 49,375
Operation and Maintenance Cost (Present Worth):	\$858,586
Total Cost:	\$1,006,186
Estimated Time to Cleanup:	>200 years on-site; >200 years offsite

Alternatives G-3a through G-3c: *In-situ* Air Stripping Source Control; These three alternatives use *in-situ* air stripping wells to treat groundwater in the highly contaminated source areas. These three alternatives are different because of how they address the potential off-site movement of the plume near Lawnfield Road. An *in-situ* air stripping well is a well in which air is injected into the groundwater at the bottom. As the air bubbles rise inside the well, volatile contaminants are transferred from the groundwater to the vapor phase. The contaminated vapors are drawn off and treated above ground, while the aerated groundwater is recirculated within the aquifer. Groundwater is repeatedly circulated through the system until sufficient contaminant removal has taken place. A typical *in-situ* air stripping well is shown in **Figure 5**.

Alternative G-3a: *In-situ* Air Stripping Source Control/ Monitored Natural Attenuation Plume Interception; This alternative combines *in-situ* air stripping wells to remediate groundwater in the highly contaminated source areas of the groundwater plumes with monitored natural attenuation to reduce potential off-site contamination. A total of approximately 10 air stripping wells would be installed in Plumes 1, 2, 3 and 4. The air stripping wells would be connected with pipes to five above-ground control buildings. The contaminated vapors would be collected and treated with activated carbon to remove the VOCs before being discharged to the atmosphere. These control buildings would resemble an outdoor equipment shed and house an air blower, vacuum pump and the carbon sorption container. The used carbon is sent to a permitted facility for treatment and reuse.

In-situ air stripping would be operated for a period of approximately 5 to 10 years. It is expected that the majority of the contamination in the source areas would be removed in five years. EPA may decide to operate the air stripping wells for longer than 5 years because this is a new technology and there is some uncertainty about how quickly contamination will be removed. EPA would use the results of periodic groundwater monitoring to evaluate when to continue or stop operating the air stripping wells.

Natural attenuation mechanisms would be used to reduce contaminant concentrations outside of the source areas and for off-site migration. No other actions would be taken to prevent contaminated groundwater from migrating off-site in the future. Modeling predicts that on-site groundwater concentrations, after completion of the *in-situ* remediation, would exceed the provisional cleanup goals for approximately 90 years while undergoing natural attenuation. Therefore, monitoring would be conducted for 90 years to monitor the effectiveness of natural attenuation to reduce the groundwater VOC concentrations in the source areas. Off-site monitoring wells also would be installed on the private property owned by radio KEX north of the site. Modeling predicts that there is a potential for off-site groundwater exceedances of the provisional cleanup goals to a maximum distance of 100 feet north of Lawnfield Road for approximately 60 years. Therefore, groundwater samples would be taken annually for this time period and analyzed for VOC and degradation products (PCE, TCE, DCE and vinyl chloride), and for parameters that indicate conditions supportive of natural attenuation processes.

Institutional controls such as property use restrictions or restrictive easements on Parcel A and B would be implemented to prevent future human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes.

Capital Cost:	\$1,178,100
Annual Operation and Maintenance Cost:	\$ 161,250
Operation and Maintenance Cost (Present Worth):	\$1,498,624 (5 yr) to \$1,929,255 (10 yr)*
Total Cost:	\$2,676,724 to \$3,107,355
Estimated Time to Cleanup:	90 years on-site; 60 years off-site

* O&M costs are shown as a range depending on how long the air stripping wells operate.

Alternative G-3b: *In-situ* Air Stripping Source Control / *In-situ* Air Stripping Plume Interception (EPA's Preferred Alternative); This alternative uses *in-situ* air stripping wells to treat both the source areas and the contaminated groundwater plume, eliminating the potential for the contaminated groundwater to move off the site at concentrations exceeding the provisional cleanup goals.

The *in-situ* air stripping systems for the source areas, and the associated on-site performance monitoring and modeling results, are the same as described for Alternative G -3a. *In-situ* air stripping would be operated for a period of time (5 to 10 years) and in a manner similar to Alternative G-3a.

Monitoring wells would be constructed upgradient and downgradient of Plume 4 and groundwater samples would be taken annually to monitor the effectiveness of the *in-situ* air stripping wells.

Annually, EPA would evaluate the monitoring data and make a determination of whether or not Plume 4 contamination is being reduced sufficiently by the source area *in-situ* air stripping systems to prevent off-site migration. If EPA decides that Plume 4 contamination is not being reduced sufficiently then an additional system of approximately four *in-situ* air stripping wells would be installed in the vicinity of Lawnfield Road. These *in-situ* air stripping wells would take out the volatile contaminants from groundwater before it moved off the site. The contaminated vapors collected by the wells would be treated with activated carbon to remove the VOCs before being discharged to the atmosphere. Actual VOC emissions would be negligible.

Institutional controls such as property use restrictions or restrictive easements on Parcels A and B would be implemented to limit human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes.

Capital Cost:	\$1,607,100
Annual Operation and Maintenance Cost:	\$ 194,400
Operation and Maintenance Cost (Present Worth):	\$2,103,342 (5 yr) to \$2,533,972 (10 yr)
Total Cost:	\$3,710,442 to \$4,141,072
Estimated Time to Cleanup:	60 years on-site; immediately off-site

* O&M costs are shown as a range depending on how long the air stripping wells operate.

Alternative G-3c: *In-situ* Air Stripping Source Control/ Pump and Treat Plume Interception; This alternative uses *in-situ* air stripping wells to treat source areas. This alternative would work like Alternative G-3a in the following: the *in-situ* air stripping systems, monitoring and modeling, operations and number of years.

For this alternative, the off-site movement of Plume 4 contaminated groundwater would be prevented by a pump and treat system. A row of approximately 5 groundwater extraction wells would be installed in the vicinity of Lawnfield Road. Contaminated groundwater would be pumped out of these wells, rather than being allowed to move off the site. A combined pumping rate of 25 gpm would be sufficient to contain the plume from moving off-site across Lawnfield Road. Extracted groundwater would be piped to an above-ground air stripper where volatile contaminants would be stripped from the groundwater. Chlorinated VOC emissions to the atmosphere from the air stripper are estimated to be about 6 lbs/year. About 13 million gallons per year of treated groundwater would be generated and discharged into the western manmade drainage channel. Periodic discharge sampling would ensure that discharge criteria were met. Samples would be collected from the extracted groundwater and from monitoring wells installed downgradient of Plume 4 to monitor the effectiveness of the groundwater extraction system.

Modeling predicts that it will take approximately 60 years to achieve the provisional cleanup goals. Therefore, hydraulic containment at the northern property boundary would be required for 60 years or until cleanup goals are achieved. Modeling also predicts that on-site groundwater would exceed the provisional cleanup goals for approximately 70 years. Therefore, on- and off-site monitoring would be required during these time periods.

Institutional controls such as property use restrictions or restrictive easements on Parcels A and B

would be implemented to limit human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes.

Capital Cost:	\$1,372,030
Annual Operation and Maintenance Cost:	\$ 190,500
Operation and Maintenance Cost (Present Worth):	\$2,013,485 (5 yr) to \$2,444,115 (10 yr)
Total Cost:	\$3,385,505 to \$3,816,135

Estimated Time to Cleanup: 60 years on-site; immediately off-site

* O&M costs are shown as a range depending on how long the air stripping wells operate.

Alternatives G-4a through G-4c: Pump and Treat Source Control; These alternatives share a common approach to source areas, pump and treat, but are different because of how they address the potential off-site movement of the plume near Lawnfield Road.

Alternative G-4a: Pump and Treat Source Control/Monitored Natural Attenuation Plume Interception; This alternative uses pump and treat systems to remove and treat groundwater in the highly contaminated source areas of the site and monitored natural attenuation to control the potential off-site movement of Plume 4. A total of approximately eight groundwater extraction wells would be installed in Plumes 1, 2, 3 and 4. These wells would be used to pump contaminated groundwater from below ground to above the ground where the groundwater is then piped to an air stripping system. The air stripper treats the groundwater by removing the volatile contaminants from the groundwater. The total flow of extracted groundwater would be 35 gpm. Combined chlorinated VOC emissions from the air strippers to the atmosphere would be approximately 300 lb/year. About 18.5 million gallons per year of treated groundwater would be generated and discharged into the western drainage channel. Routine sampling of the treated water discharge would be conducted to evaluate compliance with discharge criteria.

Pump and treat systems would be operated for a period of 30 years, which is the time period estimated to achieve federal and state drinking water MCLs. Natural attenuation would be used to further reduce contaminant concentrations below the MCLs to the risk-based PRGs. Modeling predicts that on-site groundwater concentrations, after pump and treat remediation, would exceed the provisional cleanup goals for approximately 70 years. Groundwater monitoring on site would occur during this time.

Natural attenuation would be used to reduce contaminant concentrations outside of the source areas of the plumes and to control off-site movement of Plume 4. No other actions would be taken to prevent contaminated groundwater from moving off-site. The natural attenuation monitoring and institutional controls would be the same as those described for Alternative G-3a. Modeling predicts that there is a potential for groundwater exceeding the provisional cleanup goals to move off-site, to a maximum distance of 100 feet north of Lawnfield Road, for approximately 60 years. Therefore, off-site monitoring of natural attenuation would be required for 60 years.

Institutional controls such as property use restrictions or restrictive easements on Parcel A and B would be implemented to limit human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes.

Capital Cost:	\$464,670
Annual Operation and Maintenance Cost:	\$124,900
Operation and Maintenance Cost (Present Worth):	\$2,241,386
Estimated Total Cost:	\$2,706,056
Estimated Time to Cleanup:	70 years on-site; 60 years off-site

Alternative G-4b: Pump and Treat Source Control / *In-situ* Air Stripping Plume

Interception; This alternative uses pump and treat systems to remove and treat groundwater in the highly contaminated source areas of the site and air stripping wells to control the potential off-site movement of Plume 4. The pump and treat systems and the performance monitoring and modeling are the same as described for Alternative G-4a.

If monitoring shows that Plume 4 contamination is not reduced sufficiently by the source area pump and treat systems to prevent off-site migration, a system of approximately 4 *in-situ* air stripping wells would be installed just south of Lawnfield Road. These *in-situ* air stripping wells would operate to strip the volatile contaminants from groundwater before it flowed off-site. The contaminated vapors collected by the wells would be treated with activated carbon to remove the VOCs before being discharged to the atmosphere.

Modeling predicts that there is a potential for groundwater exceeding the provisional cleanup goals to move off-site, to a maximum distance of 100 feet north of Lawnfield Road over a period of about 60 years. Therefore, *in-situ* air stripping for plume interception may be required at the northern property boundary for 60 years. Monitoring wells would be constructed downgradient of Plume 4 to detect off-site contaminant movement and groundwater samples would be taken annually and analyzed to monitor the effectiveness of the *in-situ* air stripping wells.

Institutional controls on Parcels A and B would be implemented to limit human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes.

Capital Cost:	\$959,670
Annual Operation and Maintenance Cost:	\$156,800
Operation and Maintenance Cost (Present Worth):	\$2,828,730
Total Cost:	\$3,788,400
Estimated Time to Cleanup:	60 years on-site; immediately off-site

Alternative G-4c: Pump and Treat Source Control / Pump and Treat Plume Interception;

This alternative uses pump and treat systems to both remove and treat groundwater in the highly contaminated source areas of the site and to control the potential off-site movement of Plume 4. The pump and treat systems and the monitoring and modeling for the source areas are the same as described for Alternative G-4a.

Under this alternative, off-site movement of contaminated groundwater would be prevented by installing a pump and treat system just south of Lawnfield Road. The pump and treat system for plume interception, and the monitoring and modeling are the same as described for Alternative G-3c.

Modeling predicts that there is a potential for groundwater exceeding the provisional cleanup goals to move off-site, to a maximum distance of 100 feet north of Lawnfield Road, for approximately 60 years. Therefore, a pump and treat system at the northern property boundary may be required for 60 years. Modeling also predicts that on-site groundwater would exceed the provisional cleanup goals for approximately 70 years. Therefore, on-site monitoring would be required for this amount of time.

Institutional controls on Parcels A and B would be implemented to limit human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes.

Capital Cost:	\$654,000
Annual Operation and Maintenance Cost:	\$153,900
Operation and Maintenance Cost (Present Worth):	\$2,769,538
Total Cost:	\$3,423,538
Estimated Time to Cleanup:	70 years on-site; immediately off-site.

Alternatives G-5: Site-Wide Pump and Treat; This alternative uses a pump and treat system to remove and treat all on-site groundwater that exceeds the provisional cleanup goals. The groundwater extraction system would include a total of 15 extraction wells, with a combined flow of 150 gpm.

Extracted groundwater would be piped to an above-ground air stripper where volatile contaminants would be stripped from the groundwater. Because of the distances between extraction wells, two treatment systems would be needed. Chlorinated VOC emissions from the air strippers to the atmosphere are estimated to be about 330 lbs/year. About 80 million gallons per year of treated groundwater would be generated and discharged into the western drainage channel. Routine sampling of the treated water discharge would be conducted to evaluate compliance with discharge criteria.

Groundwater monitoring would be conducted to monitor the decrease in groundwater VOC concentrations resulting from the pump and treat systems. Based on groundwater modeling, site cleanup would require the pump and treat system to operate for approximately 30 to 40 years. Because the extraction wells along the northern property boundary provide hydraulic containment, no off-site exceedances of the provisional cleanup goals are predicted.

Institutional controls on Parcels A and B would be implemented to limit human exposure to on-site groundwater contaminants during the time period of treatment and to ensure access for monitoring purposes.

Capital Cost:	\$795,420
Annual Operation and Maintenance Cost:	\$191,400
Operation and Maintenance Cost (present worth):	\$3,441,757
Total Cost:	\$4,237,177
Estimated Time to Cleanup:	30-40 years on-site; immediately off-site

CRITERIA USED BY EPA TO EVALUATE ALTERNATIVES

EPA's Superfund program uses nine nationally established criteria to evaluate and compare cleanup alternatives. The criteria are divided into three categories as follows:

Threshold Criteria

- Overall Protection of Human Health and the Environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The alternative that EPA selects must comply with the threshold criteria.

Balancing Criteria

- Long-term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume through Treatment
- Short-term Effectiveness
- Implementability
- Cost

These criteria are used by EPA to choose between alternatives that meet the threshold criteria.

Modifying Criteria

- State Acceptance
- Community Acceptance

EPA uses the information received from the community and the Oregon Department of Environmental Quality to determine if new information or additional considerations warrant a change to the preferred alternative.

EPA selects an alternative once the alternatives have been evaluated using the nine criteria. EPA then writes a Record of Decision (ROD) to document the selection. EPA then proceeds to design the remedy and construct it.

EVALUATION OF ALTERNATIVES

The following summarizes the cleanup alternatives and provide a narrative description comparing the alternatives with one another under each criterion. The "no action" alternative does not provide overall protection of human health and the environment. EPA cannot select an alternative that does not satisfy this threshold criteria, and this alternative is not carried forward for evaluation beyond the threshold criteria.

Please note that this Proposed Plan provides only a summary of EPA's evaluation. The detailed analyses performed for the site can be found in the FS Report. This text focuses on the primary

distinguishing factors EPA considered in selecting its Preferred Alternative.

1. Overall Protection of Human Health and the Environment - *Determines whether a remedial action eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.*

All of the alternatives except the “no action” alternative would provide adequate protection of human health and the environment from direct contact with groundwater contaminants by eliminating, reducing, or controlling risk through engineering and/or institutional controls. However, some alternatives provide more protection than others. Alternative G-5 (sitewide pump and treat) is most protective of human health and the environment because it would reduce contamination across the entire site and is predicted to meet site RAOs in the shortest time period (30 to 40 years). Alternatives G-3b and G-3c, which use *in-situ* air stripping for source control, are considered more protective than G-4b and G-4c (pump and treat), because *in-situ* air stripping is expected to reduce high VOC concentrations in the source areas in only 5 to 10 years. Alternatives G-3a and G-4a are less protective because they depend on natural attenuation to control movement of the plume and may not be effective enough. Alternative G-2 is significantly less protective because it relies on institutional controls and natural attenuation over a time period of 200 years to reduce risks. Alternative G-1 (no action) is not protective because no controls are taken to prevent exposure to contaminated groundwater. For all alternatives (except no action), the effectiveness of the alternative is dependent on how well the institutional controls prevent exposure to contaminated groundwater until the cleanup goals are achieved.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) - *Evaluates whether a remedial action meets state and federal environmental laws and regulations that pertain to the site.*

All alternatives, except G-1 (no action), would be designed to meet their respective ARARs from Federal and State laws. Although all alternatives would eventually meet federal drinking water MCLs and the more stringent cleanup goals, the time periods until these levels are achieved vary considerably. Alternative G-5 would attain cleanup goals on-site within 30 to 40 years. Under Alternatives G-3b and G-4b, cleanup goals would be met after approximately 60 years. Alternatives G-3a and G-4a would attain the cleanup goals on-site in approximately 90 years, while G-3c and G-4c would require 70 years. Alternative G-2 would require more than 200 years to attain the cleanup levels. Alternatives G-3b, G-3c, G-4b, G-4c and G-5 would meet cleanup goals off-site immediately. Alternatives G-3a and G-4a, which include natural attenuation for off-site plume control, are estimated to require 60 years to meet the cleanup goals off-site.

3. Long-Term Effectiveness and Permanence - *Considers the ability of a remedial action to maintain protection of human health and the environment over time and the reliability of such protection.*

Alternative G-5 and the *in-situ* air stripping alternatives, G-3b and G-3c, have the highest long-term effectiveness because they would permanently reduce risks associated with the source areas and prevent off-site risks by preventing off-site migration of Plume 4. Pump and treat source control alternatives (G-4b and G-4c) are considered less effective than *in-situ* air stripping because they can exhibit an impaired ability to reduce contaminant levels over time (“tailing

effect”). Alternatives G-2, G-3a and G-4a are less effective because site conditions may not support natural attenuation processes over time and off-site migration of Plume 4 may occur. Alternative G-1 (no action) is the least effective and permanent because site risks would not be reduced.

4. Reduction of Toxicity, Mobility and Volume Through Treatment - *Evaluates a remedial action's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment and the amount of residual contamination remaining.*

Many of the groundwater alternatives use some degree of treatment to reduce the toxicity and mobility of contaminants. Alternative G-5 (site-wide pump and treat) would most effectively reduce contaminant toxicity, mobility and volume because it would treat groundwater in all areas on the site. Alternatives G-3b, G-3c, G-4b, G-4c, which use treatment for source control and plume interception, also would achieve substantial reductions in the toxicity and volume of contaminated groundwater in the source areas and reduce the mobility of contaminants in the northern portion of the site, preventing off-site movement. Alternatives G-3a and G-4a, which use natural attenuation for controlling plume movement, are considered less effective because natural attenuation processes may not be occurring to a sufficient extent. Alternative G-1 and G-2 involve no treatment to reduce contaminant toxicity, mobility and volume within a reasonable time frame.

5. Short-Term Effectiveness - *Considers how fast a remedial action reaches the cleanup goal and the risk that the remedial action poses to workers, residents, and the environment during the construction or implementation of the remedial action.*

Alternative G-5 would meet cleanup goals across the site in approximately 30-40 years. The remaining alternatives generally involve significantly longer periods of time to attain the cleanup goals; however, the *in-situ* air stripping Alternatives G-3a, G-3b and G-3c possibly may achieve significant reductions in contaminant concentrations in the source areas within five years. Natural attenuation alternatives (G-2, G-3a and G-4a) require up to 200 years to attain the cleanup goals and may not meet the goal of preventing off-site migration of Plume 4. Pump and treat Alternatives G-5 and G-4a, G-4b and G-4c pose a risk to on-site workers due to handling untreated groundwater and from contaminant releases from a failure of the water conveyance system or an upset in the air stripping system. However, personal health and safety protection measures would minimize this risk. *In-situ* air stripping Alternatives G-3a, G-3b and G-3c would pose a low risk to on-site workers because the contaminated groundwater is kept below-ground and not handled directly by workers. The vapors extracted from these *in-situ* wells, containing volatile contaminants stripped from the groundwater, could pose potential risks to workers if released to the atmosphere; the likelihood of this exposure is minimal because the vapors would be collected under negative pressure (vacuum) and then treated prior to release to the atmosphere. Construction of the pump and treat system alternatives and the *in-situ* air stripping alternatives could pose a potential for short-term worker exposure to contaminants in drill cuttings (subsurface soil) associated with constructing the wells. Workers would be required to wear appropriate levels of protection to minimize exposure during construction activities.

6. Implementability - *Considers the technical and administrative feasibility of implementing a remedial action, such as relative availability of goods and services. This criterion also considers*

whether the technology has been used successfully at other similar sites.

Alternative G-1 requires no implementation. Alternative G-2 is the second easiest to implement because it requires only groundwater monitoring and on-site institutional controls. *In-situ* air stripping (G-3a, G-3b and G-3c) would be easier to implement than pump and treat (G-4a, G-4b and G-4c) because they do not require aboveground systems for handling untreated and treated groundwater and they would be installed for a shorter period of time. Also, the pump and treat alternatives may be less feasible to implement over time because the proposed Sunrise Corridor highway project, estimated to begin in 10 years, may require extraction well abandonment and relocation. Site-wide pump and treat (G-5) would be the most difficult to implement because it would require extensive equipment, and construction, operation and maintenance effort due to the size of the system. Additionally, it would require aboveground handling of larger volumes of contaminated groundwater, and would require extensive coordination with the proposed Sunrise Corridor highway construction due to the large number of wells.

7. Cost - *Includes estimated capital, operation and maintenance costs.*

The total costs of the groundwater alternatives are summarized in **Table 1**. These costs include both capital and operation and maintenance expenditures. Costs are estimated for purposes of comparison and are considered to be accurate within -30 to +50 percent. The net present value of each alternative is calculated using a discount rate of 5 percent and an operation and maintenance period of 30 years.

No costs are associated with Alternative G-1. Alternative G-2, site-wide MNA, is the least costly of all action alternatives (\$1 M). There is negligible cost difference between using *in-situ* air stripping (for 5 years) vs. pump and treat for source control (G-3a vs. G-4a; G-3b vs. G-4b; and G-3c vs. G-4c); if *in-situ* air stripping is used for 10 years, then its costs are estimated to be approximately 10 percent higher than pump and treat. In regard to addressing future off-site plume interception, MNA alternatives (G-3a and G-4a) are less costly than pump and treat (G-3c and G-4c) which are less costly than *in-situ* air stripping (G-3c and G-4c). Site-wide pump and treat, G-5, has the highest estimated cost.

8. State Acceptance

The Oregon Department of Environmental Quality supports Alternative G-3b, *In-situ* Air Stripping Source Control / *In-situ* Air Stripping Plume Interception, which is EPA's Preferred Alternative.

9. Community Acceptance

Comments received on the Proposed Plan are an important indicator of community acceptance. Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends and will be described in the Record of Decision.

SUMMARY OF THE PREFERRED ALTERNATIVE

The Preferred Alternative for cleaning up groundwater at the NWPC site is G-3b, *In-situ* Air Stripping Source Control / *In-situ* Air Stripping Plume Interception. It includes the following:

- Installing an estimated ten *in-situ* air stripping wells in source areas of four groundwater plumes on the site to treat groundwater with the highest levels of VOCs;
- Installing monitoring wells upgradient and downgradient of Plume 4 and taking groundwater samples. Annually, EPA would evaluate the monitoring data and make a determination of whether or not Plume 4 contamination is being reduced sufficiently to prevent off-site migration. If EPA decides that Plume 4 contamination is not being reduced sufficiently then an additional four *in-situ* air stripping wells would be installed in the vicinity of the downgradient edge of Plume 4, in the vicinity of Lawnfield Road.
- Monitoring groundwater to evaluate the effectiveness of *in-situ* air stripping to reduce contaminant levels and to measure progress towards achieving groundwater cleanup goals;
- Controlling erosion during groundwater remedy construction activities to minimize impacts to downstream surface water quality and critical habitat of federally listed threatened anadromous fish;
- Limiting future domestic use of site groundwater, through the use of institutional controls such as property use restrictions or restrictive easements, to ensure the remedy remains protective of human health until the RAOs are achieved.

The Preferred Alternative will be operated for a period of approximately 5 to 10 years. It is expected that the majority of contamination in the source areas would be removed in five years. However, the amount of operational time for the treatment wells is uncertain because this is a new technology and contaminant removal rates are difficult to predict prior to actual operation. EPA will use the results of performance monitoring to periodically evaluate the effectiveness of the air stripping wells and determine how long their operation should continue.

The Preferred Alternative was selected over the other alternatives because it is expected to achieve a large reduction of risk in a reasonable period of time and in a cost-effective manner. In just five to ten years, *in-situ* air stripping wells would significantly decrease VOC concentrations in the four plumes, resulting in substantial progress towards attainment of the cleanup goals. Since the aquifer is not expected to be needed in the near future for drinking water, EPA believes it is reasonable to allow a longer time, after completion of the active treatment period, for the groundwater cleanup goals to be met. EPA expects the preferred alternative to attain cleanup goals within 60 years. EPA's preference for this alternative is based on the evaluation of the sitewide alternatives against the established criteria. It meets EPA's threshold criteria for protection of human health and the environment.

The ultimate objective for the groundwater remedial action is to restore the upper aquifer to its potential future beneficial uses to the maximum extent practicable. The future beneficial use of the aquifer is as a source of drinking water, based on EPA's groundwater classification system.

Based on the information obtained during the RI/FS and supplemental groundwater investigations, EPA and DEQ believe that the Preferred Alternative will achieve this objective in a reasonable time frame through active treatment of the most highly contaminated areas of groundwater.

Alternative G-3b is the preferred groundwater alternative because it greatly reduces human health risks by treating the highly contaminated source areas with an effective, permanent and cost-effective technology. Because source control *in-situ* air stripping would be operated for a period of 5 to 10 years, source control would likely be completed prior to the proposed Sunrise Corridor highway construction, thus minimizing associated implementation difficulties.

The preferred alternative will prevent the off-site movement of contaminated groundwater by using *in-situ* air stripping wells along the downgradient edge of Plume 4 (near the northern site boundary) to treat groundwater before it moves off the site. These air stripping wells would be installed if, based on annual reviews of monitoring data, EPA determines that the Plume 4 source area stripping wells are not effective in preventing the migration of Plume 4. Historical data trends indicate that concentrations of PCE and its breakdown products have declined systematically in the vicinity of the northern property boundary. This trend may indicate that Plume 4 is decreasing in size and retreating from the northern property boundary, making off-site migration less likely. In addition, the groundwater model included specific conservative assumptions which may have over-predicted the northward migration of Plume 4. For these reasons, installing *in-situ* air stripping wells along the northern site boundary will be done only if monitoring data shows it is necessary.

The Preferred Alternative also includes institutional controls to ensure that the remedy remains protective. Institutional controls will include protective easements on Parcels B and the western part of Parcel A to ensure groundwater use is restricted until drinking water standards are achieved. DEQ holds title to Parcel B in trust for EPA and DEQ so EPA expects that institutional controls on Parcel B will be able to be obtained and enforced. ODOT owns the west portion of Parcel A, and because ODOT has been cooperative with EPA during the site investigations and studies, EPA expects to be able to obtain enforceable institutional controls on ODOT's property.

Based on information currently available, EPA and the State of Oregon DEQ believe the Preferred Alternative provides the best balance of tradeoffs among the alternatives with respect to the evaluation criteria. EPA expects the preferred alternative to satisfy the statutory requirement in CERCLA section 121(b) to: 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element.

The estimated cost of the Preferred Alternative is as follows:

Capital Costs:	\$1,600,000
Annual Operation and Maintenance Cost:	\$ 194,400
Operation and Maintenance (present worth):	\$2,100,000 to \$2,500,000
Total Costs:	\$3,700,000 to \$4,100,000

The preferred alternative could change based on public comment and/or new information.

ADDITIONAL INFORMATION

If you have any questions about this Proposed Plan, please contact either:

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EPA Website
www.epa.gov/r10earth
click on “index” at bottom
click on “N” for Northwest Pipe & Casing Company / Hall Process Company

Table 1 - Groundwater Alternatives Cost Comparison

Alt No.	Description	Capital Cost	Annual O&M Cost	Present Worth of O&M	Total Present Worth
G-1	No Action	\$0	\$0	\$0	\$0
G-2	Monitored Natural Attenuation	\$147,600	\$49,375	\$858,586	\$1,000,186
G-3a	<i>In-situ</i> Air Stripping and Monitored Natural Attenuation	\$1,178,100	\$161,250	\$1,498,624 (5-yr) \$1,929,255 (10-yr)	\$2,676,724 (5-yr) \$3,107,355 (10-yr)
G-3b	<i>In-situ</i> Air Stripping	\$1,607,100	\$194,400	\$2,103,342 (5-yr) \$2,533,972 (10-yr)	\$3,710,442 (5-yr) \$4,141,072 (10-yr)
G-3c	<i>In-situ</i> Air Stripping and Pump and Treat	\$1,372,030	\$190,500	\$2,013,485 (5-yr) \$2,444,115 (10-yr)	\$3,385,505 (5-yr) \$3,816,135 (10-yr)
G-4a	Pump and Treat and Monitored Natural Attenuation	\$464,670	\$124,900	\$2,241,386	\$2,706,056
G-4b	Pump and Treat and <i>In-situ</i> Air Stripping	\$959,670	\$156,800	\$2,828,730	\$3,788,400
G-4c	Pump and Treat	\$654,000	\$153,900	\$2,769,538	\$3,423,538
G-5	Site-wide Pump and Treat	\$795,420	\$191,400	\$3,441,757	\$4,237,177

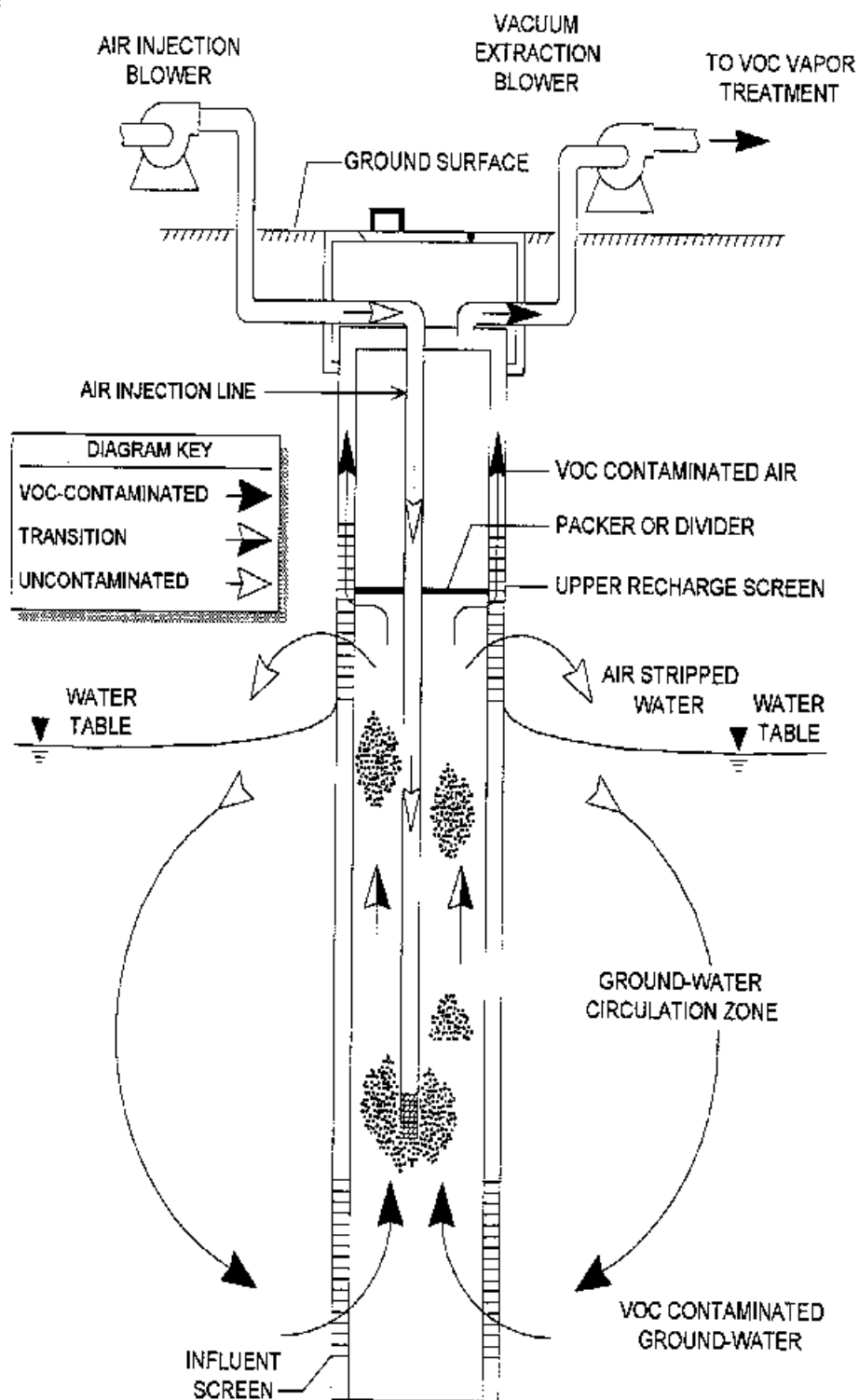
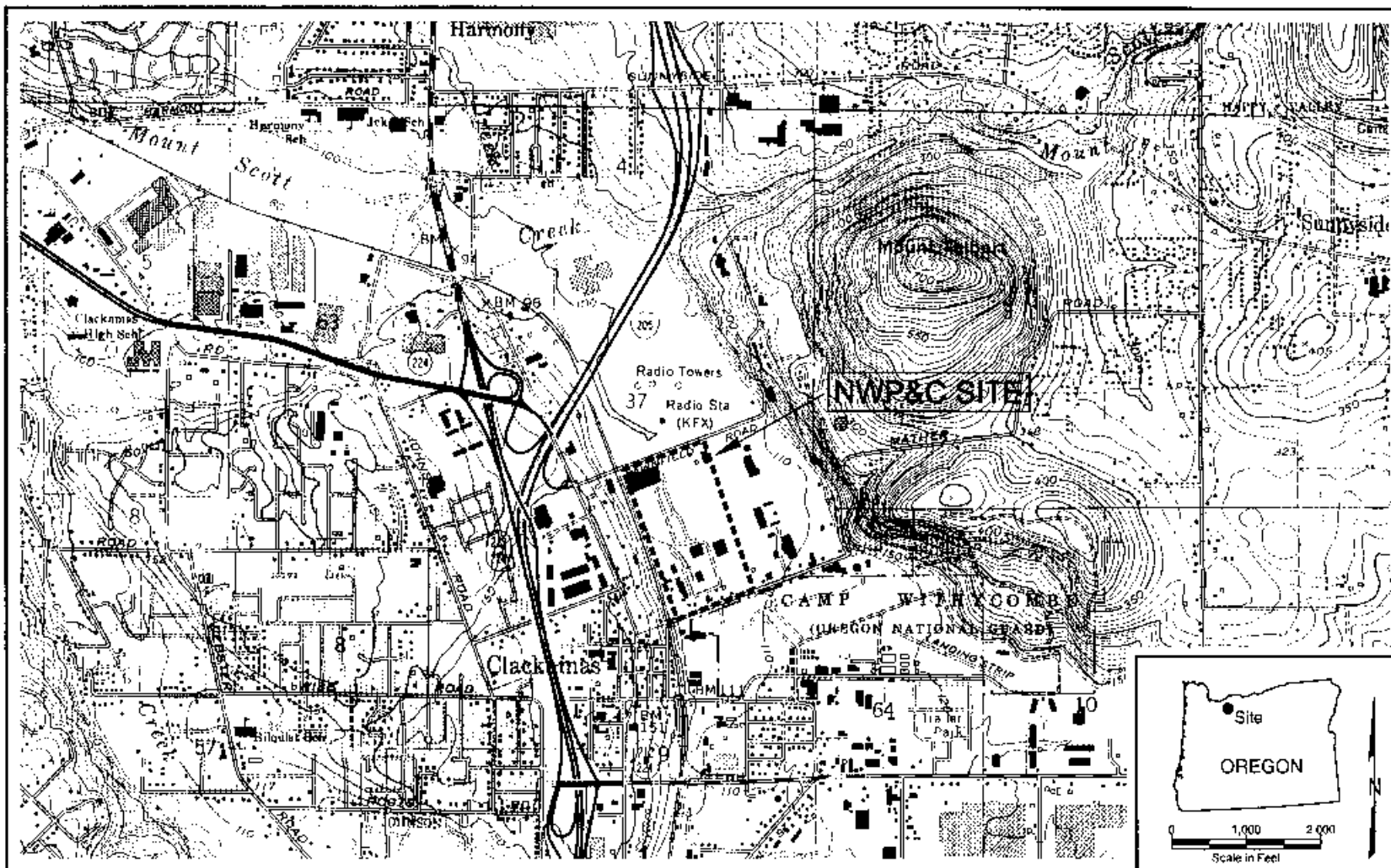


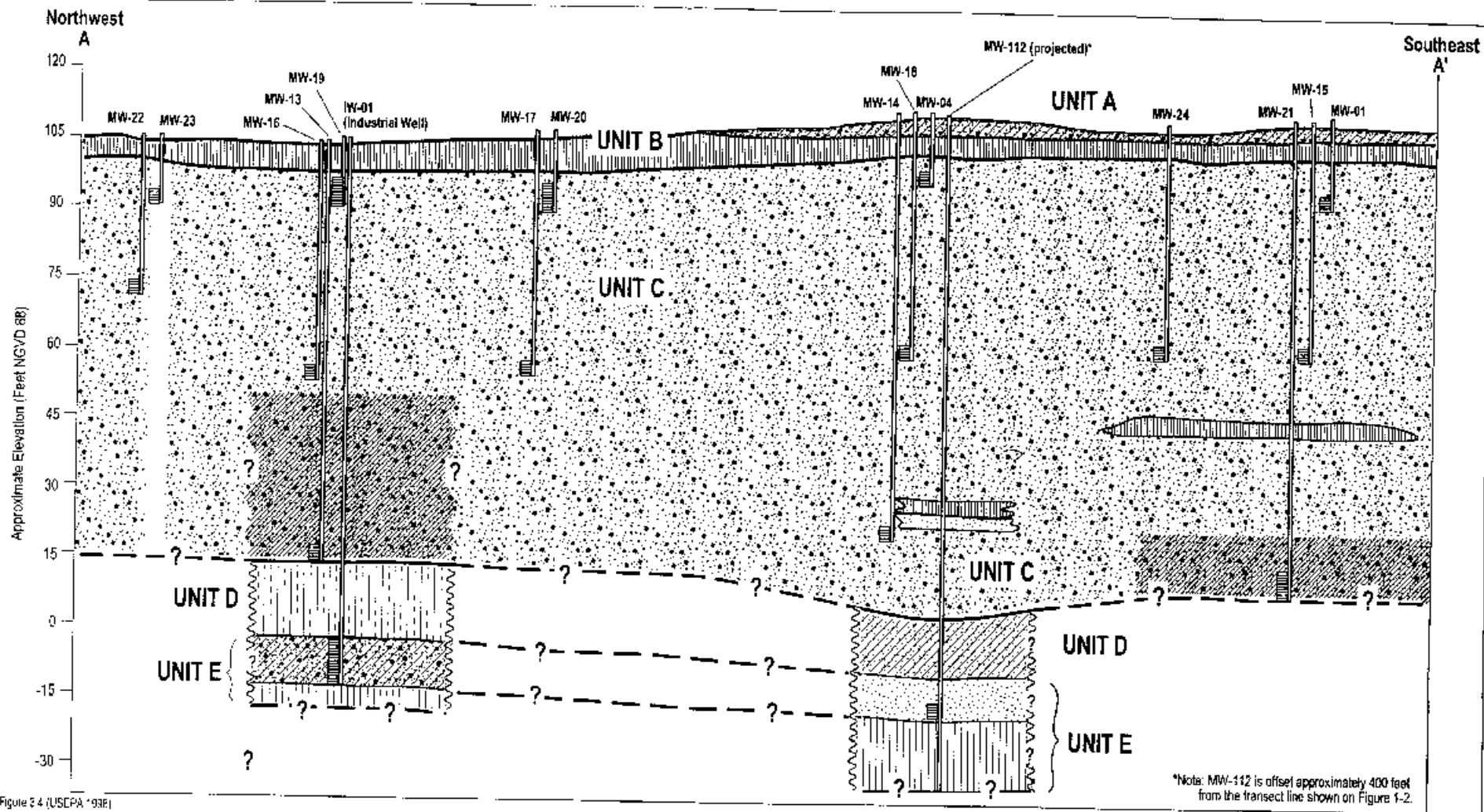
FIGURE 1. IN-WELL VAPOR STRIPPING PROCESS



EPA
REGION 10

Figure 1-1
Site Vicinity Map

030-RI-CO-10GB
Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG. 2000); 6
GW INVESTIGATION ADDENDUM



Modified from R. Figure 3-4 (USCPA '93E)

SYMBOLS

- Cementation
- Exploration Boring Showing Screen Interval
- Contact Between Units (queried where inferred)

MW-22 Monitoring Well ID

GEOLOGIC UNITS

- A** Silty gravel, fill
- B** Plastic silt with/without sand and gravel (recent alluvium)
- C** Coarse gravel, variable silt matrix, variable cemented coarse gravel, interspersed lenses of silt and sand (Pleistocene cataclysmic flood deposits)
- D** Interbedded sandy gravel and sand (Plio-Pleistocene Troutdale Formation)
- E** Hard silt with/without clay and sand (Plio-Pleistocene Troutdale Formation)

*Diller's description MW-01 (installed 1977)

0 100 200
Approximate Scale in Feet
Vertical Exaggeration Approximately 10X

Figure 4-1
Schematic Geologic Cross Section A-A'

030-RI-CO-10GB
Northwest Pipe and Casing
GROUNDWATER MONITORING REPORT (JULY - AUG. 2000) &
GW INVESTIGATION ADDENDUM

